

REMARKS

Claims 1-32 are pending in the applications. Claims 1-32 stand rejected in the referenced office action. Claims 1, 18 and 29 are independent claims.

The specifications have been amended to eliminate identification as "prior art" material that is in the priority document of the present application.

Claims 1, 18 and 29 have been amended to include a limitation of computer implementation of the method. Support for this amendment is found in paragraph [0010] of the application. (Note that the paragraph numbering used herein refers to the paragraphs of the filed application, not the paragraph numbering assigned by the USPTO in the published application.). Additional description of the computer arrangement used for implementing a dynamic range relaxation algorithm is found in the grandparent application, now US 6370491, the contents of which were incorporated by reference.

In addition, claims 1, 18 and 29 have been amended to replace intended use language with operative language.

No new matter has been added by the amendments. Reconsideration of the application as amended is respectfully requested. The Examiner's objections are

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rejections are addressed in substantially the same order as in the referenced office action.

OBVIOUSNESS TYPE-DOUBLE PATENTING

Claims 1, 18 and 29 stand provisionally rejected over the claims of co-pending application no. 09/949,966 under the judicially created doctrine of obviousness type double patenting. A terminal disclaimer is being filed concurrently with this document to address the rejection. Applicant would like to draw the attention of the Examiner to the fact that co-pending application no. 09/949,966 has been allowed and the issue fee has been paid.

REJECTION UNDER 35 USC § 101

Claims 1-32 stand rejected under 35 USC § 101 as being drawn to non-statutory subject matter. Independent claims 1, 18 and 29 have been amended to clearly specify that the claimed subject matter is a computer implemented method. This limitation is found in both the preamble and the body of the three independent claims

PREAMBLE OF THE CLAIMS

The Examiner has stated that the preamble of the claims has not been given patentable weight. With the amendments to the independent claims, intended use language has been replaced by operative language, and respectfully requests that the preamble be given patentable weight.

REJECTION UNDER 35 USC § 103

Claims 1-6, 10-12, 16-26 and 29-32 stand rejected under 35 USC § 103 over *Bourne* (SPE87523) in view of US 6078867 to *Plumb* and “further in view of applicants admission that using DRRA to find a force equilibrium is prior art.” Claims 1, 18 and 19 are independent claims.

The present invention is a computer-implemented method for modeling of faulting and fracturing that uses “small scale rules” to produce large scale results.

Organizationally, the software for the invention is made up of two parts. One part is a user interface for inputting deformations, pre-existing faults and fractures, and material rock properties. The second part of the software is the code that solves the motion of each point or node in the subsurface volume defined by the user interface. The solution code solves the forces on each node and their resulting movement. Faults and fractures occur as the nodes are widely separated and the forces between the nodes (that are based on the node locations) are changed. The user interface may be used to produce a quick look at the deformation results and to view the results of the full simulation.

Applicant respectfully requests removal of the *Bourne* reference as prior art. The *Bourne* paper was publicly presented at the 9th Abu Dhabi International Petroleum Exhibition and Conference held in Abu Dhabi, U.A.E. on 15-18 October 2000. The standard practice for the SPE is to release the conference proceedings no earlier than the

day before the conference. See information below the Copyright Notice of the paper. US Patent Application Ser. No. 09/542,307 (of which the present application is a continuation-in-part) has a filing date of April 4, 2000. This predates the publication date of *Bourne*. As the Examiner has stated in page 2 of the office action, "*Bourne* does not explicitly disclose regions including a borehole with liner or casing." *Bourne* is clearly not prior art for the remaining portions of the claimed invention..

Applicant further requests removal of *Plumb* as related prior art. The invention of *Plumb* is directed towards "generation of various portions of 3D graphics representation of a borehole." See col. 3 line 67-col. 4 line 2. The display in *Plumb* comprises caliper data (which relate to internal borehole geometry) with color coding for gamma ray logs and is irrelevant to the present invention, which relates to mechanical deformation based on mechanical properties, and specifically, deformation and faulting of at least one region away from the borehole. A word search of *Plumb* shows no use of the words "fracture", "fault", and "deform", all key concepts of the present invention. As the Examiner has noted, *Plumb* does discuss a borehole mesh model consisting of interconnecting nodes. The Examiner has misconstrued *Plumb* to be used for "modeling analysis of wellbore failure;" instead, *Plumb* is simply a visualization program that, *post facto*, displays the geometry of the borehole with certain color coded information relating to formation properties. Applicant further notes that the display such as that in Fig. 4 consists of a "stack of ellipses 100 approximating the shape of the borehole." See col. 4 lines 40-42. This is not a true 3D mesh and simply represents the wall of the borehole.

Turning now to claim 1, we note that it specifies that the material properties have a statistical variation. A search of *Bourne* and *Plumb* shows no such teaching. In fact, *Bourne* appears to teach away from the use of statistical models. Attention of the Examiner is drawn to the following from *Bourne*:

“Traditional methods of fracture modelling are geostatistical and somewhat different to the model described above. They rely on stochastic realisations of the large numbers of fracture networks consistent with borehole fracture data to explain inflow data. This approach is ultimately limited to near-well scales as it lacks information on how fracture statistics change away from wells. A field-scale stochastic fracture model would require an enormous number of evenly distributed wells to allow simple interpolation of fracture statistics between the wells.” Page 5, col. 2.

Applicant further draws the attention of the Examiner to the following from *Bourne*:

“**Continuum mechanical models.** We consider deformation of the reservoir to be distributed smoothly on length-scales of interest. In this way we can combine knowledge of the regional stress history and the mean rock strength to calculate a smooth field of stress. Large discontinuities in the deformation field, such as seismically visible faults must be represented in the model explicitly rather than as part of the continuum.” Page 2, col. 1 ¶ 1.

This is interpreted by the Applicant as stating that the faulting is **not** the result of an initial deformation that is modeled; instead, the fracturing is explicitly specified as part of the model.

Applicant further notes that while DRRA has been admitted as being prior art, it is not relevant to the present invention. Attention of the Examiner is drawn to **col. 10 lines 48-51** of US 6370491, the patent issuing from the grandparent application

"The method of the present invention combines the basic Dynamic Range Relaxation Algorithm (DRRA) with steps that include fracturing and faulting. This is a novel aspect of the present invention."

There is **no admission** on the part of the Applicant that DRRA with steps that involve fracturing and faulting is prior art. Applicant respectfully submits that the Examiner cannot rely on DRRA for the element of fracturing in independent claim 1. Applicant regrets any confusion caused by incorrect identification as "prior art" material in the specifications that is in the grandparent application.

In order for a claimed invention to be unpatentable under 35 USC § 103, the prior art of record must, when combined, disclose each and every limitation of the claim. In addition, there must be a teaching or suggestion in the prior art to combine them to come up with the claimed invention.

The first requirement is not met here. In addition, the Examiner is using hindsight in combining references from unrelated fields (including one which teaches away from the claimed invention), a reference that is not prior art, and imputing an admission that was never made, as the basis for a rejection when there is no teaching or suggestion in the

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prior art to combine the references.

Accordingly, applicant respectfully submits that claim 1 and claims 2- 17 that depend upon claim 1 are patentable under 35 USC § 103 over *Bourne* in view of *Plumb* and the prior art of record.

Independent claim 18 has the substantive limitations of claim 1 discussed above. Accordingly, applicant further submits that claim 18 and claims 19-28 that depend upon claim 18 are also patentable under 35 USC § 103 over *Bourne* in view of *Plumb* and the prior art of record for the same reasons that claim 1 is patentable under 35 USC § 103 over *Bourne* in view of *Plumb* and the prior art of record.

Independent claim 29 has the substantive limitations of claim 1 discussed above. Accordingly, applicant further submits that claim 29 and claims 30-32 that depend upon claim 18 are also patentable under 35 USC § 103 over *Bourne* in view of *Plumb* and the prior art of record for the same reasons that claim 1 is patentable under 35 USC § 103 over *Bourne* in view of *Plumb* and the prior art of record.

The application is believed to be in condition for allowance. A check in the amount of \$130.00 is enclosed for the accompanying terminal disclaimer. The Commissioner is authorized to charge any deficiencies and credit any overpayments to **Deposit Account No.13-0010 (CON-1021US)**

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Respectfully submitted,



Kaushik P. Sriram
Registration No. 43,150
Madan Mossman & Sriram, P.C.
2603 Augusta, Suite 700
Houston, Texas 77057
Telephone: (713) 266-1130
Facsimile: (713) 266-8510